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SCIENCE AND TECHNOLOGY OF PAPER.

Paper Technology. An Elementary Manual on the Manufacture, Physical Qualities, and Chemical Constituents of Paper and of Paper-making Fibres.

By R. W. Sindall. Pp. xv+253. (London: Chas. Griffin and Co., Ltd., 1906.) Price 12s. 6d. net.

IN the author's preface it is stated that this work took shape in a course of lectures delivered at Exeter Hall in 1904-6. There is a suggestion here that "Exeter Hall" has extended its "mission" sphere to the paper-maker, but the impression is only momentary.

As a matter of fact, the treatise is designed more expressly for the other side of the paper industry, the buyers and consumers, that is, it deals with paper from the point of view of the stationers, printers, bookbinders, and publishers; moreover, the treatment is severely material, strictly limited to "things" and to the exposition of their relations in accordance with the title and subtitle.

The first page reveals the author's purpose and method, which are entirely practical. There may be some who would question the "practical" qualifications of a technologist who gives prominence to the "ideal paper," which subject is treated in chapter i. as a *résumé* of the discussion of the important section on chemical and physical constants.

We may clear away an ambiguity associated with this well-known adjective in relation to our subject. The "practical paper-maker," as ordinarily so defined, limits his conduct and control of the processes which he superintends to sense impressions—what he can see—the appearance of the "stuff" in the beater or on the machine wire; what he can feel—the "handle" of the stuff in the beater or of the finished sheet; what he can hear—the hum of the beater roll as the measure of the distance from the bed-plate, and the beating work of his machine; what he can smell and taste are also taken as evidences of states and conditions of his material in process.

The "practical" buyer judges a paper by the eye, the hand, the tongue—an excellent provider of a slightly alkaline fluid for testing "sizing" efficiency—the ear for "rattle"—and he avails himself also of the sixth sense, muscular sense, in measuring the mechanical properties of resistance to pulling or tearing strains.

The technologist, on the other hand, sets out from the position that the actual phenomena which condition the qualities of the finished paper are mainly the invisible and intangible; they are molecular, and belong to the invisible region of the scientific imagination, and can, therefore, only be followed by the methods of science.

If we substitute for "practical" the word *thorough*, the technologist may leave the empiric invested with his lesser qualifications, and appropriate the higher designation commensurate with his comprehensive survey of fundamental principles.

The author's present contribution to the technical literature of paper-making is entirely in this spirit. The second chapter, on "technical difficulties," enforces the useful moral of the relation of difficulty and the critical investigation of defects to progress. The examples are well chosen, and it is easy to see that they represent actual working experiences.

Following these preliminary chapters we have a brief account in successive chapters of paper-making processes, classified in the accepted order, rag papers, esparto and straw, wood pulp, and the miscellaneous group of packing papers and boards. A feature of these chapters is the generalised summary of technical effects given in tabular form. Thus on pp. 48-9 is a tabulated outline of the processes involved in the preparation of half-stuff of the six leading types and grades; Table vi., p. 51, is a comparison of times of beating in relation to half-stuff and to quality of finished paper.

Table ix., p. 77, is a fitting conclusion to the section on wood pulp, giving the details of consumption of fibrous materials, fuel and water for providing the paper for a daily journal with a circulation of 200,000.

It may be noted that one average conifer furnishes the pulp for 1000 copies of the average "daily," and the coal consumed is equal to the weight of the paper produced, and may, by the way, be taken to represent many times this weight of the products of antecedent forest growth. Such tables occur throughout the book, and give an original impress to matter which otherwise treated would have the unrelieved character of "stock" information.

The section on "art" papers is an original discussion of their qualities and *defects*, with indications of the lines of investigation along which progress may be made, to the much desired ideal printing surface, which shall not involve the sacrifice of those qualities in the body-paper conditioning permanence. Our "art" papers are an interesting study in compromise, and our "imitation art" papers are still more interestingly artful. The author treats them with respectful impatience!

Upon this necessary groundwork the manual proceeds to develop the subject of physical, mechanical and chemical qualities and properties of papers, the methods of investigation adopted by the "expert," the numerical expression of the results, with a critical discussion of the value of the constants arrived at. In this section the author devotes a chapter to a further *exposé* of the "C.B.S. units," in which special attention is paid to the volume-composition of papers and to breaking strains reduced to the actual unit of sectional area of the paper. These units have proved of value in practice, and their usefulness must be insisted upon, especially in educating the young technologist to associate with his tests mental pictures conformable with the actualities of paper. In these respects the otherwise comprehensive unit of the "breaking length" adopted by the German pioneers in this branch of technology has been found wanting.

In those sections devoted to paper testing, which make up more than half the volume, the author takes pains to make his exposition lucid. We note an occasional slip, as in dealing with the question of a coloured ash left on burning a paper. "If blue, ultramarine, Prussian blue, or smalts may be present." This must be corrected as regards the cyanide blue. Again:—"the blue is tested by boiling with caustic soda and filtering." "The Prussian blue passes into solution." This inaccuracy will be evident to the chemist.

In the section on the estimation of moisture we find the expression "bone dry" for "oven dried." Bones are not dry to the chemist, only to the poet.

In the "dictionary of chemical terms" and the "glossary of various papers" which make up the concluding chapters we also note a number of slips, which perhaps may be explained by the laudable aim at short, crisp definitions; but this hardly excuses the description of caustic soda as "prepared by boiling carbonate of soda with quicklime"; bleaching powder as a "dry pulverulent powder prepared by exposing dry powdered quicklime to chlorine gas"—the italics here are our "note of exclamation"; "dextrine" as industrially obtained "by the action of boiling dilute sulphuric acid on starch"; "dicotyledon" as including the Coniferæ with angiosperms, such as beech and ash.

These descriptive terminologies are excellent in plan, and generally useful. They should be carefully revised, and perhaps amplified, in future editions. A section on bibliography would be a useful addition, and we think it is due from the author to acknowledge more fully the sources of much of the matter in this book, especially the German text-books and publications, of which he fully avails himself. The book is fully illustrated, and the matter thereby pointed and elucidated.

It is evident that the work is one we can appreciatively commend to the very wide circle of those interested in "paper"; as for the paper-makers, the author only indulges, with becoming modesty, the "hope that this book may prove useful to them." We think they will see the value of keeping pace with the critical knowledge of the consumers.

WEIGHTS AND MEASURES.

Outlines of the Evolution of Weights and Measures and the Metric System. By Dr. William Hallock and Herbert T. Wade. Pp. xi+304. (New York: The Macmillan Company; London: Macmillan and Co., Ltd., 1906.) Price 10s. net.

THE literature of weights and measures is very extensive, and, as a rule, singularly uninteresting. Messrs. Hallock and Wade are therefore to be congratulated on having produced a treatise on the subject which is at once instructing and attractive. For this is an admirable piece of work, in which the result of much tedious research is presented in a bright and lucid narrative. The first chapter is devoted to a brief review of the speculations of metro-

logists and antiquaries concerning the weights and measures of the ancients. It includes a particularly good account of the Babylonian units and the various theories respecting them which have been deduced from the Senkereh tablet and the scale of Guldea. After a rapid survey of the weights and measures of the Hebrews, the Greeks and the Romans, the authors pass on to consider the systems in vogue in Great Britain and in France from the earliest times up to the end of the eighteenth century. The next two chapters and the fifth deal with the origin and extension of the metric system. They trace the system from its embryonic stage in the writings of Mouton, Picard, Huygens, and Cassini, to its fully-elaborated form in the law of April 7, 1795. The geodetic work of Delambre and Méchain is next described, and the opportunity is taken to introduce short explanations of a trigonometrical survey and of the determination of latitude. An account follows of the construction of the metric standards of the French Archives and of the lengthy interregnum of *mesures usuelles*.

The meeting of the International Geodetic Association at Berlin in 1867 marks an important epoch in the history of the metric system. The authors describe the influential part played by it in securing the establishment of the International Metric Commission. This leads to an interesting account of the International Committee of Weights and Measures and its bureau at Sevres. In this connection it may be mentioned that, owing to the death of the British representative early last year, this country is at present not represented on the International Committee. The power of appointing a member to fill the vacancy rests with the committee itself. In 1884 the committee had some difficulty in finding a suitable representative for this country owing to the fact that the officer in charge of our Standards Department at that time, although an official of standing, was comparatively unknown in the scientific world. At the present time, now that all the metric prototypes have been distributed, and thus the most important object of the convention achieved, it is absolutely necessary in order that the United Kingdom may continue to derive any advantage from its contributions to the funds of the Metric Bureau, that the representative of this country on the committee should be an official of the Government department which is charged with the construction and preservation of the Imperial and metric standards. It will accordingly, no doubt, be a matter of considerable satisfaction to the International Committee that the recently appointed Deputy Warden of the Standards is an eminent man of science, in every respect worthy of membership in that distinguished body which has included on its roll such names as Mendeléeff, Bertrand, Foerster, Mascart, Christie, and Michelson.

In their fourth chapter Messrs. Hallock and Wade have set themselves the congenial task of explaining the standards of weight and measure in vogue in their own country. The desirability of a simple and uniform system of weights and measures was fully